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CASE REPORT

Case report of complete dislocation of T1–T2 without neurological deficit and review of the literature

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Fracture-dislocations of the thoracic spine comprise about 16% of all thoracic and lumbar fractures,[4] and are commonly caused by high-speed road accidents. Unlike the cervical spine, the thoracic spine is stabilized by its connection to the rib cage by transverse costal ligaments. The position of the articular facets provides resistance to axial rotation and horizontal translation.[1,4] Therefore, a severe injury is required to bring about a fracture-dislocation at this level. These injuries, due to the narrowness of the thoracic canal and the precarious blood supply of the cord, lead to complete paraplegia in more than 80% of cases.[1,4,8,12,13]

Thoracic spine fracture-dislocations that are not accompanied by neurological damage are extremely rare, and only a few cases are described in the literature.[3,5,7,9,10,11,14,16–19,20]

We present here a case of complete posterior dislocation of the first thoracic vertebra over the second without neurological damage, and we discuss its surgical treatment.

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Case report

A 21-year-old man was involved in a motorcycle accident and suffered multiple injuries. He did not lose consciousness, and was taken to a nearby hospital by ambulance. Radiographs of the thoracic spine were taken (Fig. 1), as well as CT scans of the head, chest and abdomen. These revealed pulmonary contusions, bilateral haemothoraces, bleeding from the bottom of the left kidney, damage to the left ureter, and fractures of the 10th and 12th ribs. Two days later the ureteric lesion was treated with a stent. Later, the patient began to complain of back pain and paraesthesia in the lower limbs. A CT scan and MRI of the thoracic spine revealed an initially unidentified T1–T2 fracture-dislocation (Figs. 2 and 3). The patient was brought to our hospital for treatment.

On admission, the patient's general condition was good. He had no motor deficits, and sensitivity had returned to normal.

We decided to reduce and stabilize the dislocation surgically. First, we performed a T1 and T2 wide laminectomy and a complete excision of the T1–T2 disc by a posterolateral approach (so as to reduce the amount of overlap between the two segments of thoracic spine). By combined traction and leverage,

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Figure 1 Preoperative anteroposterior radiograph of the thoracic spine, initially seemed to be negative for fracture luxation. However, a reduced distance can be seen between the T1 and T2 peduncles, due to luxation.

Figure 2 Preoperative sagittal MRI showing total luxation of T1—T2.

with the dural sac widely exposed, we achieved a good reduction and realignment of the spine, as well as the complete circumferential release of the dura. A C6—T6 fixation was made with a specific cervicothoracic system with double diameter titanium rods. We could not perform a posterior fusion owing to the extensive iatrogenic destruction of bone (Fig. 4), and therefore, a week later, the operation was completed by anterior fusion. We used a standard pre-sternocleidomastoid approach to the cervicothoracic spine by ligation of the inferior thyroid peduncle. Temporary section of the sternothyroid and sternoioideus muscles allowed a wider view of the upper thoracic spine. Following posterior discectomy we found tight contact between T1 and T2 endplates and bone grafts could not be inserted between them. We achieved anterior fixation with a titanium plate and screws over C7, T1, and T2 (Fig. 5). The patient was discharged from hospital 6 days later. He wore a postoperative orthosis for the next 3 weeks. His neurological status remained unimpaired and he resumed work 1 year after surgery (Fig. 6a and b).

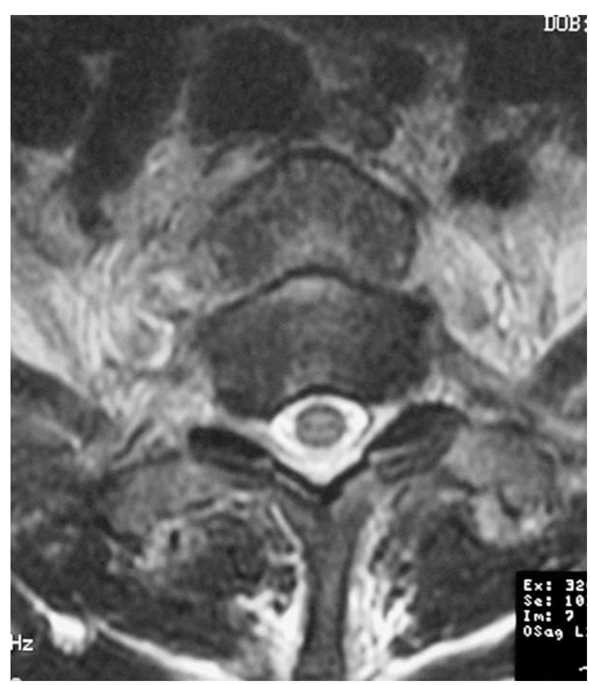

Figure 3 Axial MRI showing the luxation and the almost total overlap of the two vertebrae.

Figure 4 CT scan after posterior stabilisation surgery. An incomplete reduction can be seen as well as the need for anterior stabilisation.

Discussion

Fracture-dislocations of the thoracic spine without neurological deficit are very rare. Only 15 cases are reported in the literature.[3,5,7,9,10,11,14,16—19,20] They were young patients with a mean age of 34 years (range 17—66 years). The level of dislocation was between the third and the tenth thoracic vertebra: T3—T4 in two cases, T5—T6 in four cases, T6—T7 in four cases, T7—T8 in two cases, T8—T9 in one case, and T9—T10 in two cases.

Fracture-dislocations involving the first two thoracic vertebrae have not been previously reported in the literature.

Treatment was surgical in 10 cases (in two cases by an anterior approach, in 5 by a posterior approach, and in 3 by a combined approach), and in 5 cases treatment was conservative (rest in bed, immobilisation with a halo jacket). In 14 cases neurological function was preserved, and one resulted in intercostal neuralgia (Table 1).

According to the classification by Magerl et al.[13] almost all of the fracture-dislocations described in the literature belong to the C1.2.4 category—fractures with a split in the frontal plane, involving several levels and defined as 'vertebral body separation'. A characteristic of this lesion is the fracture of the pedicles that leads to a widening of the vertebral canal in the sagittal plane. In our case, the lesion was type B3.3, where the pure posterior dislocation following the disc lesion, together with the posterior arch fracture of T2, which remained connected to the superior segment of the spine, enabled neurological function to be preserved.

Figure 5 CT scan (at 3 months) after anterior stabilisation. Posterior and anterior stabilisation were necessary to prevent secondary dislocation and ensure long-term mechanical stability.

Analysing the biomechanics of spinal lesions, Roaf[15] found that the spine is very vulnerable to shear and rotational forces. Mechanisms of hyperflexion or hyperextension alone can barely cause a fracture-dislocation, but if they are combined with rotational force, mechanical failure is more likely to

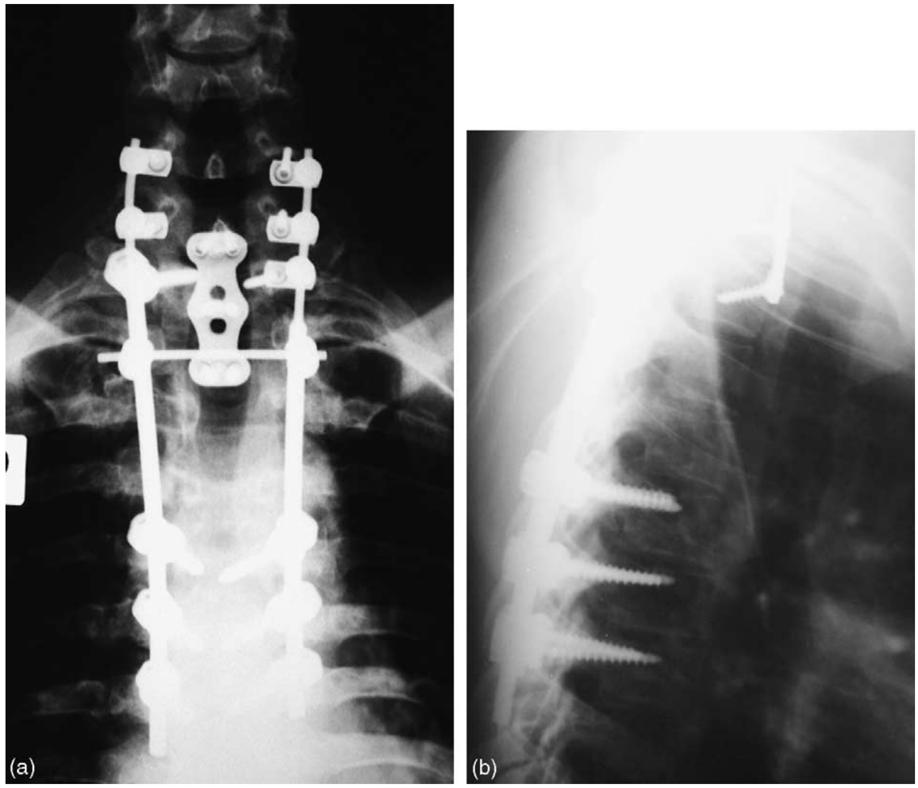

Figure 6 (a and b) Postoperative radiographs 1 year 5 months after surgery.

occur. Depending on the additional compressive load, a fracture of the vertebral body might also occur, described as a 'burst-dislocation' by Hanley and Eskay,[6] and in most cases, it is the inferiorly involved vertebra that fractures. That did not happen in our case, probably due to an extension rather than a rotation mechanism.

Most lesions of the mid-thoracic spine may be helped by the horizontal orientation of the vertebrae around the apex of the kyphosis.[6]

According to Miyasaka et al.[14] the spinous processes at this level extend more inferiorly than in any other segment of the spine, and therefore, they remain intact and the strong shear forces are concentrated in the middle part of the spine, and cause the corresponding pedicles to fracture. A common feature of these lesions is the fracture of the peduncle or lamina, which permits the separation of the anterior column and mid-column from the posterior column. Therefore, the spinal cord is not compressed or stretched severely by the displacement of the vertebral body. In addition, MRI shows the ability of the cord to deform, or at least to modify its original form, preserving its neurological function.

Bohler[2] subdivided the fracture-dislocations into those with rotational and translation dislocation (laminae and pedicle), which have a high rate of paraplegia, and those with fracture of the posterior element, defined as 'saving fractures of the neural arch', which preserve the neural elements.

The aim of the treatment of these lesions is to preserve neurological function and to restore spinal alignment and stability to prevent further displacement and secondary neurological damage.

Unlike thoracic fracture-dislocations belonging to group C1.2.4, where the main damage involves

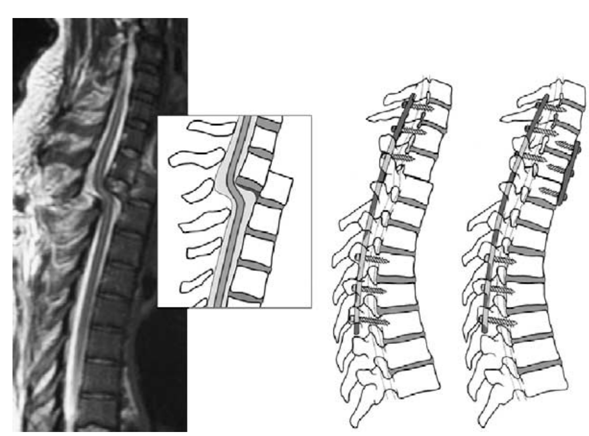

Figure 7 Diagram showing the injury, initial reduction and stabilisation by a posterior approach, and the following anterior stabilisation.

Table 1 Summary of the characteristics of cases previously published thoracic fracture-dislocation without neurologic damage

Characteristic	Number of patients
Sex	
Male	10
Female	5
Mean age (years)	34
Cause	
Motor-cycle accident	7
Car accident	6
Fall from horse	1
Plane crash	1
Level	
T3/T4	2
T5/T6	4
T6/T7	4
T7/T8	2
T8/T9	1
T9/T10	2
Injury	
Thoracic pain	15
Rib fractures	14
Hemothorax	8
Anterior subluxation	6
Translation	15
Kyphosis	6
Bilateral pedicle fractures	15
Treatment	
Non-operative	5
Anterior approach	2
Posterior approach	5
Ant and post approach	3
Outcome	
Normal neurological outcome	14
Intercostal neuralgia	1

the bone (and therefore can be treated conservatively), in our case the main injury was to the disc and ligaments, thus leaving the spine very unstable and incapable of fusing spontaneously. Therefore, surgical treatment was necessary. We opted for a posterior approach to achieve a wide view of the neural canal during reduction manoeuvres. After demolishing the bone to achieve good reduction and lower the neurological risk, we could not achieve an effective posterior fusion. Therefore, anterior fusion was carried out to ensure long-term mechanical stability and prevent any secondary dislocation (Fig. 7).

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